Contribution of dietary snacking behaviours to discretionary energy intake and anthropometric measures in Australian adults: A comparison using an objective vs subjective definition for snacking

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Published in:
Nutrition and Dietetics

DOI:
10.1111/1747-0080.12648

The contribution of dietary snacking behaviours to discretionary energy intake and anthropometric measures in Australian adults: a comparison using an objective versus subjective definition for snacking

Running heading: Dietary snacking patterns of Australian adults

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Manuscript words: 3,929 (including references)

Abstract words: 247

Abstract

Aim: There is limited information on the snacking behaviour of Australian adults, and the role of snacking in the diet may depend on how it is defined. This study aimed to compare the dietary snacking behaviours and associated nutritional intake and body composition in Australian adults, using an objective versus a subjective definition for snacking.

Methods: Cross-sectional data were analysed from the 2011-12 National Nutrition and Physical Activity Survey (n = 8,361, 19+ years). Objective snacking was defined based on time of day between main meals. Subjective snacking was self-reported by participants.

Results: Using the objective definition, 88.2% of adults were snack consumers; where snacking contributed 20.0% (SD: 20.0%) of total daily energy intake and 27.0% (SD 31.4%) of total daily discretionary energy. 41.3% (SD 37.1%) of snacking energy intake came from discretionary foods. Using the subjective definition, 98.5% of adults were snack consumers, where discretionary foods contributed 52.6% (SD 35.2%) of all snacking energy. The proportion of objective and subjective snacking energy from discretionary foods did not differ across BMI groups.

Conclusions: Objective snacking energy contributed more to core food groups than discretionary, was not associated with anthropometric measures, and contributed less to total discretionary energy than the evening meal. When snacking was defined subjectively, more than half of snacking energy was discretionary, suggesting that adults are more likely to perceive discretionary foods as snacks. Differences between snacking definitions means that associations between self-reported snacking and diet or health outcomes, should be interpreted with caution.

Keywords: nutrition assessment; energy intake; cross-sectional studies; diet, Western; snacks

Introduction

Globally, the dietary pattern of snacking is becoming increasingly popular. Snacking prevalence in adults ranges from 35% in China [1], to 73% in Mexico, 74% in Brazil [2,3], 77% in Canada [4] and up to 97% in the United States of America (USA) [5]. Although there is no consensus on the relationship between snacking and health [6], snacking is often perceived as synonymous with consumption of highly processed or discretionary foods and beverages [7,8], poor diet quality [9] and weight gain [10-12]. As such, there have been recommendations that snacking frequency be reduced [7,8]. However, snacking appears to facilitate energy balance in individuals with a recommended body mass index (BMI) (18.5 to 24.9 kg/m^2) [13] and can add beneficial nutrients to the diet [14].

There is inconsistency in how snack foods and snacking are defined. A snack food can be defined by its nutritional composition, time of consumption or be self-reported by the consumer [15,16]. Snacking behaviour may be defined by the time of consumption, the contribution to total energy intake, meal frequency, reported eating occasion, a combination of nutritional composition and temporal patterns, or whether it was motivated by hunger [5,10,15]. The lack of a universal definition impacts the interpretation of the snacking literature and limits development of evidence-based snacking dietary recommendations [15,16].

There is limited information on the snacking behaviour of Australian adults, and the prevalence and contribution of snacking to the Australian adult diet is unknown. With nearly two thirds of Australian adults classified as overweight or obese according to

BMI [17] and a high intake of discretionary foods [18,19], there is a need to investigate snacking in the Australian population and the associations that snacking has with the types of foods and beverages that are consumed, their contribution to energy and nutrient intakes, and the relationship with age, sex, and measures of body composition. Given the lack of a universal definition for snacking, there is also a need to determine the differences between definitions. Therefore, this study aimed to compare the dietary snacking behaviours and associated nutritional intake and body composition in Australian adults, using an objective versus subjective snacking definition.

Methods

This cross-sectional study has been reported according to the STROBE statement [20]. Cross-sectional data from the 2011-12 National Nutrition and Physical Activity Survey (NNPAS) were used. The NNPAS is a nationally representative survey that was part of the 2011-13 Australian Health Survey conducted by the Australian Bureau of Statistics (ABS) [18], the methodology of which has been reported in detail elsewhere [21]. Briefly, 9341 adult (19-years or older) survey participants had their dietary intake assessed using an Automated Multiple-Pass Method to capture all foods and beverages consumed in the 24 hours prior to the interview day. Due to differences in meal patterns between weekdays and weekends, only weekdays were included [22-24]; therefore, a total of 8361 adults were included in the current analysis. The interview components of the survey were conducted under the Census and Statistics Act 1905 and therefore ethics approval was not necessary.

Objective and subjective definitions to measure snacking were used. For the objective definition, daily energy contribution was charted at half-hour intervals and meal periods began at the first energy increase and ended in the trough [25]. The three largest peaks were classified as main meals and the three smaller peaks were classified as between main meals (snacking time periods). Snacking time periods were thus classified as morning: 9.30am – 12.00pm, afternoon: 2.30pm – 5.30pm, and late night: 9.30pm – 5.30am (Figure 1). A snacking occasion was defined as the consumption of one or more food or beverage items if the consumption fell within the snacking time periods. For the subjective definition, participant defined snacking occasions were used. During the dietary recall interviews, respondents classified the reported eating occasion (REO) for each food and beverage consumed from a list of 11 pre-defined options which included four main meals (breakfast, brunch, lunch and dinner) and seven subjective snacking eating occasions (morning tea, afternoon tea, supper, snack, beverage/drink, extended consumption and other).

Dietary intake was calculated by the ABS using the 2011-13 Australian Food, Supplement and Nutrient Database (AUSNUT) developed by Food Standards Australia New Zealand (FSANZ) [26]. The contribution to total snacking energy from each sub-major food group, the proportion of consumers who reported snacking, and the portion size in grams per consumer of each sub-major food group was calculated. The mean daily energy intake and energy intake during each snacking time period (objective definition), the contribution from energy during snacking to total daily energy intake, the contribution from snacking to protein, fat, carbohydrate and total and added sugars were also calculated. Discretionary foods and beverages were

defined according to the Australian Dietary Guidelines which are foods and drinks not necessary to provide the nutrients the body needs, and are those high in saturated fats, added sugars, added salt, or alcohol and low in dietary fibre [27]. Discretionary foods in the survey were coded as discretionary by the ABS. The total daily discretionary energy intake, discretionary intake during snacking, contribution from snacking to total daily discretionary energy and contribution of discretionary energy to total snacking energy were calculated.

Respondents' anthropometric measures, including weight, height and waist circumference, were measured during NNPAS interview. BMI was calculated as kg/m^2, and participants' BMI and waist circumference were categorised according to the World Health Organisation [28].

The statistical package SPSS version 23.0 (IBM Corp., Armonk, NY, USA) was used for all analyses, with a p-value <0.001 treated as significant. General linear models were used to investigate the effects of a standard set of predictor variables (age group, sex, their interaction, total energy intake and BMI group); the response variables included proportion of energy from snacking, proportion of discretionary energy from snacking, proportion of energy from discretionary foods and number of snacking occasions. ANOVA tables and Chi-squared tests were used to indicate significant variables, and Bonferroni post-hoc analyses were performed to show pairwise significance between categories of respondents. Dependent t-tests were used to determine significant differences between the objective and subjective snacking definitions. Confidence intervals have been used for population proportions to show the precision of the result

and the sampling error. Standard deviations have been provided for population means to indicate the variance of the sample.

Results

Of the 8361 adults, the majority were female (51.1%), aged 19-50 years (59.8%), and had a BMI >30kg/m^2 (62.5%) (Table 1). The majority of adults were objective snack consumers (88.2%) and the highest prevalence of objective snacking was among those aged 31-50-years (89.8%; p<.001), with no significant difference in prevalence according to sex (Table 1). Females had more objective snacking occasions than males (2.2 versus. 2.0; p<.001) and the most popular snack time period was morning (68.4%), compared to afternoon (59.4%) and late night (31.6%; Table 1). In a model for number of objective snacking occasions with age group, sex, their interaction, energy intake, adiposity (waist circumference or BMI), only sex and energy intake were significant, and the *R*-squared value was only 5%. (Table 1).

Objective snacking contributed 1.8MJ (SD 2.1), or 20.0% (SD 20.0%) of total daily energy intake, and relative to its energy contribution, provided a smaller proportion of daily protein [16.2% (SD 20.6%)], and greater carbohydrate [22.5% (SD 21.0)], total [27.8% (SD 24.9%)] and added sugars [28.3% (SD 31.9%)] (Table 1). The highest proportion of objective snacking energy intake came from the morning snack period (43.8%; Figure 2). Discretionary energy at all three snacking time periods combined contributed to 9.2% of total daily energy intake and 41.3% (SD 37.1%) of snacking energy intake came from discretionary foods (Table 1). Among objective snacking time periods, discretionary foods from the afternoon contributed the most to daily energy

(3.7%, 95% CI 3.3-4.1%) and was the most discretionary-dense (50% of energy intake from discretionary foods) (Figure 3).

Of the top ten food groups contributing to energy intake during snacking, five were core foods: dairy milk, pome fruit, regular breads and bread rolls, nuts and nut products; and tropical and subtropical fruit; and four were discretionary foods: sweet biscuits; cakes, muffins, scones, cake-type desserts; sugar, honey and syrups; and chocolate and chocolate-based confectionery. Coffee and coffee substitutes (the 10th food group), which may include both core and discretionary foods, had the largest per-consumer daily grams consumed among the top ten food groups using the objective snacking definition (median 250g, interquartile range: 200–330 g). Dairy milk was the food group that contributed the most to snacking energy intake (mean 7.6%, SD 0.2%) and had the highest prevalence of consumers (30.4%; Table 2).

In a model for the proportion of daily energy from discretionary foods, age group, the interaction of sex and age group, energy intake, and BMI group were all significant and the R-squared was 5.1% (Table 1). Adults classified as having the recommended BMI (18-25kg/m^2) had a significantly lower proportion of their energy from discretionary foods (41.6%) than those classified as obese (45.4%) (p=0.008) but not overweight (41.7%) (Table 1).

Prevalence of snacking was greater using the subjective definition (98.5%) compared to using the objective definition (88.2%), as were the mean frequency of snacking occasions (3.9 versus 2.1 occasions respectively; Table 2). Mean energy intake from subjective snacking was 2.3 MJ (SD 2.2 MJ) which represented 25.8% (SD 18.6%) of

total daily energy, compared to a mean of 1.8 MJ (SD 2.1 MJ) and 20.0% (SD 20.0%) of daily energy during objective snacking periods. Using the subjective compared to the objective definition, snacking contributed similar amounts to daily protein, but more to total fat, carbohydrate, total and added sugars (Table 2).

Using the subjective definition, almost half (46.2%) of the discretionary energy came from snacking, compared to 27.0% when objectively defined. Discretionary foods contributed 52.6% (SD 35.2%) of all subjective snacking energy and 41.3% (SD 37.1%) of objective snacking energy. Most of the top food groups were similar across the two snacking definitions, but only in the subjective definition were beers and wines included (Table 2). In models measuring the proportion of snacking energy from discretionary foods adjusted for age group, sex, their interaction, energy intake, and BMI group; for both snacking definitions age group and energy intake were significant, but not BMI group, and the R-squared was 2% for the objective definition and 3% for the subjective definition.

Discussion

Snacking behaviour was highly prevalent among a representative sample of Australian adults, particularly during the morning. The prevalence of snacking and the contribution to discretionary energy was greater when the subjective definition rather than objective definition was applied. This may be because people perceive discretionary foods as snacks, rather than actual between meal snacking. When objectively defined, snacking contributed more to core food group energy than discretionary energy and the discretionary energy from snacking was not associated with BMI, while overall discretionary energy intake was.

Australian snacking prevalence and its contribution to total energy intake is generally consistent with other developed countries [5,8,29,30]; however, snacking behaviour patterns differ, possibly due to cultural differences. In Australia, snacking was most prevalent in the morning; whereas in the USA, Mexico, Brazil, and China, afternoon and late night snacking were the most prevalent [1-3,30,31]. This finding demonstrates the need for nation-specific public health messages and guidelines on snacking given its high prevalence, but also the potential for contribution to the intake of core food groups. Using the objective definition, this study found that under half of snacking energy came from discretionary foods, but more than half, when the subjective definition was used. This demonstrates that snacking is not synonymous with the intake of discretionary foods but may be perceived to be so. Snacking is a prominent dietary pattern in Australia, that has increased over time in frequency and energy contribution [25]. Since 67-97% of Australian adults fall short of dietary recommendations for each of the five core foods groups [32], there is potential for snacking to help address this national dietary shortfall.

The finding that dairy, fruit and breads are some of the leading food groups that contributed to snacking is consistent with other data globally [3,14,33], and suggests that reducing snacking could have potential negative implications for the consumption of these food groups and the nutrients they provide. Given that 44% of objective snacking energy was derived from discretionary foods and that snacking contributed more to daily added sugars intake than to daily energy intake, there is still an opportunity to improve the nutritional quality of snacking. Snacking recommendations may need to

focus on replacing discretionary foods with snack foods from the five core food groups, rather than limiting snacking entirely.

Using the subjective definition, this study found snacking frequency was high and contributed 54% to total added sugars. This is consistent with a previous study in Australian men that reported a positive association between snacking frequency and added sugars intake [34]. Interventions that promoted fruit for snacking have demonstrated improvements in the total dietary quality, including a reduction in added sugars [35,36] and reduced unhealthy snacking [37]. This may be particularly relevant for the afternoon snacking period, which was the most discretionary dense snacking time period.

A number of studies have suggested that discretionary foods correlated with total energy intakes, both across the day [38,39] and longitudinally over time [40,41]. This study highlights that whilst snacking is often regarded as a top contributor of discretionary food intakes, the high discretionary energy intake among Australian adults is a concern across both main meals and snacking eating occasions. Interventions aimed at reducing discretionary food intake should consider the intake across the entire day, prioritising the evening meal which had the highest total discretionary energy of any eating time period.

Interestingly, whilst the proportion of energy from total discretionary foods was associated with BMI, the proportion of energy from discretionary foods during snacking and the number of snacking occasions, was not. It is possible that the contribution of discretionary food intake from snacking, at 27% of total discretionary

energy intake, is insufficient to be independently associated with BMI. The literature on the association between eating occasions and anthropometric measures is consistent with the current findings, with literature reviews generally reporting that eating and snacking frequency are not uniquely associated with body weight [15,42-44]. There may also be compensation for energy consumed in snacks by consuming less energy at main meals, as seen in recent research [45]. A cluster analysis of the snacking patterns of American adults found that different patterns of snacking had different associations with both BMI and waist circumference [46]. Associations between discretionary energy, snacking and adiposity measures in cross-sectional studies may also be explained by confounding or reverse causality. A universal definition for snacking and subsequent clinical trials is required to better understand the relationship between snacking and anthropometry, with consideration to these complexities, before authoritative recommendations on snacking and weight management can be established.

Interestingly, beer and wines were only among the leading food groups when the subjective definition was applied. This may be due to these discretionary foods being consumed during main mealtimes but subjectively regarded as a snack. It is also likely that these foods and beverages are the main reason why discretionary energy differed between subjective and objective snacking, since the other leading food groups for objective and subjective snacking were similar. Core foods eaten during snack periods, when defined objectively, may have also been regarded as a main meal not as snacking, such as dairy milk or bread. Regular breads and bread rolls were the fifth leading food group contributor to total energy from snacking when defined

objectively, but outside the top ten when defined subjectively. It has been reported that healthy foods were more likely to be viewed as meals than as snack foods [47]. Given the cognitive bias for snacking with discretionary energy and subsequent food intake, associations between self-reported snacking and diet quality should be interpreted with caution. The findings also suggest that eating occasion-based recommendations may need to clearly define snacking or be in the context of the time of day.

Limitations of the current study include that the objective method does not account for diets that do not fit this assumed pattern of eating [48], such as those of shift workers or with different cultural eating practices. Cross-sectional data are observational, precluding causal conclusions to be drawn. By nature, dietary recall is often affected by under-reporting, which can influence the associations for eating patterns [49]; however, under-reporters were not excluded as doing so may lead to selection bias and inflated associations, particularly when investigating dietary patterns [50,51]. The reported eating occasion 'beverage/drink' was included in the subjective definition. Future research could include 'beverage/drink' as a separate category from both snacking and main meals to determine if the current findings are specific to foods or beverages. Finally, there are opportunities for future research to perform multivariate analyses to explore what other factors (e.g. behavioural, health, environmental and socioeconomic), and how the interrelationship of these factors, affect snacking habits and discriminate between objective and subjective snacking.

Snacking eating behaviour was highly prevalent among Australian adults, comprised of both core and discretionary foods, and contributed more than a 20% of total energy

intake. The contribution of snacking to discretionary intake was associated with its definition, where subjectively defined it contributed more than half of total discretionary intake, suggesting that adults are more likely to perceive discretionary foods as snacks. Associations between self-reported snacking should be interpreted with caution as self-reported snacking is associated with a cognitive bias towards discretionary energy that may not reflect the time of consumption.

Conflict of interest: FFM, AM, TC, KT, MB, MW, PP, and SM independently work for Nutrition Research Australia, which is gains funding for projects from government, not-for-profits, professional, community, and industry organisations. FFM, AM, TC, KT, MB, MW, PP and SM declare no conflicts of interest. The funding body, Nestlé Australia Ltd had no contribution to the draft analysis plan, the data analysis, or drafting of the manuscript.

Funding: This project has been funded by a research grant from Nestlé Australia Ltd.

Authorship: All authors have reviewed and approved the final version of this manuscript prior to submission and declare this work has not be submitted for publication elsewhere. FM led the drafting of the manuscript. AM and PP conducted the data analysis. All authors contributed to the revision of the manuscript and study concept

Acknowledgements: The authors would like to acknowledge Dr Jean Kim, Nestlé Australia, who provided top line suggestions on the proposed manuscript.

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Figure legends

FIGURE 1: Percent of energy consumed by time of day and classification of meal and snack time periods as follows: breakfast (5.30am – 9.30am), morning snack (9.30am – 11.30am), midday meal (11.30am – 2.30pm), afternoon snack (2.30pm – 5.30pm), evening meal (5.30pm – 9.30pm), late night snack (9.30pm – 5.30am). Data from adults 19+y from the 2011-12 National Nutrition and Physical Activity Survey.

FIGURE 2: Based on the objective definition of snacking: per capita contribution of main meals and snacking periods to total energy intake (percent of total energy with 95% confidence intervals shown, and mean energy intake) among Australian adults 19+y. Main meals occurred between 5.30am – 9.30am, 11.30am – 2.30pm, and 5.30pm – 9.30pm. Snacking periods occurred between 9.30am – 11.30am (morning snack), 2.30pm – 5.30pm (afternoon snack), and 9.30pm – 5.30am (late night snack). Data from the 2011-12 National Nutrition and Physical Activity Survey.

FIGURE 3: Based on the objective definition of snacking: per capita contribution of main meals and snacking periods to total energy intake by core versus discretionary foods among Australian adults 19y+ (error bars show 95% confidence intervals). Main meals and snacking periods defined as breakfast (5.30am – 9.30am), morning snack (9.30am – 11.30am), midday meal (11.30am – 2.30pm), afternoon snack (2.30pm – 5.30pm), evening meal (5.30pm – 9.30pm), late night snack (9.30pm – 5.30am). Data from the 2011-12 National Nutrition and Physical Activity Survey.

Table 1: Descriptive characteristics and snacking [(a)] patterns of 8,361 adults 19+y from the 2011-12 National Nutrition and Physical Activity Survey

Characteristic	Results	*P*-value
Females (%)	51.1	
Age group (%)		
19-30y	22.8	
31-50y	37.0	
51-70y	29.2	
71+y	11.0	
Weight status (%) [(b)]		
Underweight	1.8	
Normal weight	35.7	
Overweight	36.4	
Obese	26.1	
Waist circumference category (%) [(c)]		
Not at risk of metabolic complications	37.5	
Increased risk of metabolic complications	23.0	
Greatly increased risk of metabolic complications	39.5	
Prevalence of snacking (%) [(d)]	88.2 [87.5 – 88.9]	
Prevalence of snacking by sex (%) [(d)]		0.11
Males (n=4092)	87.7 [86.7 – 88.7]	
Females (n=4269)	88.8 [87.8 – 89.7]	
Prevalence of snacking by age group (%) [(d)]		<0.001
19-30y (n=1909)	87.7 [86.2 – 89.1]	
31-50y (n=3091)	89.8 [88.8 – 90.9]	
51-70y (n=2440)	88.0 [86.7 – 89.3]	
71+y (n=921)	84.8 [82.5 – 87.1]	
Prevalence of consumption at each meal and snacking period (%) [(d)]		<0.001
Breakfast	89.4 [88.7 - 90.1]	
Morning snack	68.4 [67.4 - 69.4]	
Midday meal	87.4 [86.6 - 88.1]	
Afternoon snack	59.4 [58.4 - 60.5]	
Evening meal	97.0 [96.6 - 97.4]	

Late night snack	31.6 [30.6 - 32.6]	
Frequency of snacking (%)		
Non-snack consumers (0 snacking occasions)	11.8	
1 snacking occasion	25.2	
2 snacking occasions	29.8	
3 snacking occasions	18.4	
4+ snacking occasions	14.8	
Number of snacking occasions [e]	2.1 (1.4)	
Number of snacking occasions by sex [e]		0.093
Males	2.1 (1.4)	
Females	2.1 (1.4)	
Number of snacking occasions by sex [f, g]		<0.001
Males	2.0 [1.9 – 2.1]	
Females	2.2 [2.1 – 2.3]	
Number of snacking occasions by age group (mean) [e]		0.015
19-30y	2.1 (1.5)	
31-50y	2.1 (1.4)	
51-70y	2.1 (1.4)	
71+y	2.0 (1.4)	
Proportion of total energy from discretionary foods by BMI group (%) [f, h]		<0.001
Underweight	32.5 [29.0 – 36.0] [*,**]	
Normal weight	29.8 [29.0 – 30.6] [*]	
Overweight	32.6 [31.8 – 33.4] [*]	
Obese	33.5 [32.6 – 34.5] [*]	
Proportion of snacking energy from discretionary foods by BMI group (%) [f, i]		0.008
Underweight	44.7 [37.6 – 51.8]	
Normal weight	41.6 [39.9 – 43.2]	
Overweight	41.7 [40.0 – 43.3]	
Obese	45.4 [43.4 – 47.3]	
Total energy intake (MJ) [e]	8.5 (3.6)	
Energy during snacking (MJ) [e]	1.8 (2.1)	
Energy contribution of snacking to total energy intake [e]	20.0 (20.0)	

Contribution from snacking to total macronutrient intake [e]	
Protein	16.2 (20.6)
Fat	19.8 (22.9)
Carbohydrate	22.5 (21.0)
Total sugars	27.8 (24.9)
Added sugars	28.3 (31.9)
Total discretionary [j] energy intake (MJ) [e]	2.9 (2.5)
Contribution of snacking to total discretionary energy [e]	27.0 (31.4)
Energy from discretionary food during snacking [e]	41.3 (37.1)

a. Based on the objective definition of snacking which uses time of day to define main meals and snacking periods. Snacking periods occurred between 9.30am – 11.30am (morning snack), 2.30pm – 5.30pm (afternoon snack), and 9.30pm – 5.30am (late night snack)
b. Based on BMI: underweight (<18.5), normal weight (≥18.5, <25.0), overweight (≥25.0, <30.0), obese (≥30.0).
c. Based on World Health Organization cut-offs for waist circumference: not at risk of metabolic complications (females: <80cm; males: <94cm); increased risk of metabolic complications (females: ≥80cm, <88cm; males: ≥94cm, <102cm); substantially increased risk of metabolic complications (females: >88cm; males: >102cm) [28].
d. Data are expressed as % [95% confidence interval].
e. Data are expressed as mean (standard deviation).
f. Data are expressed as mean [95% confidence interval].
g. Adjusted for age group, their interaction, waist circumference, BMI group, and energy intake.
h. Adjusted for sex, age group, their interaction, BMI group, and energy intake. Age group, the interaction of sex and age group, energy intake, and BMI group were significant in the model, R-squared = 0.051; p<0.001 for all.
i. Adjusted for sex, age group, their interaction, BMI group and energy intake. Age group and energy intake were significant in the model, R-squared = 0.019; p<0.001 for all.
j. Discretionary foods are defined by the Australian Dietary Guidelines as foods and beverages not necessary for a healthy diet and are generally high in saturated fat and/or added sugars, added salt or alcohol and low in fibre [52].

[*,**] Different superscript Asterix denote significant difference between groups (p<0.001) by post hoc, Bonferroni.

Table 2: Snacking patterns and comparison of the top 10 sub-major food and beverage groups by percent energy contribution to snacking among 8,361 Australian adults 19y+ from the 2011-12 National Nutrition and Physical Activity Survey based on the objective and subjective snacking definitions

Characteristic	Objective definition [a]	Subjective definition [b]
Prevalence of snacking (%) [c]	88.2 [87.5 – 88.9]	98.5 [98.2 – 98.8] *
Frequency of snacking (%)		
Non-snack consumer (0 snacking occasions)	11.8	1.5
1 snacking occasion	25.2	8.2
2 snacking occasions	29.8	15.4
3 snacking occasions	18.4	21.4
4+ snacking occasions	14.8	53.5
Number of snacking occasions [d]	2.1 (1.4)	3.9 (2.1)
Energy during snacking (MJ) [d]	1.8 (2.1)	2.3 (2.2) *
Energy contribution of snacking to total energy intake (%) [d]	20.0 (20.0)	25.8 (18.6) *
Contribution from snacking to total macronutrient intake (%) [d]		
Protein	16.2 (20.6)	16.0 (16.3) **
Fat	19.8 (22.9)	23.2 (21.4) *
Carbohydrate	22.5 (21.0)	29.5 (20.6) *
Total sugars	27.8 (24.9)	42.7 (27.0) *
Added sugars	28.3 (31.9)	46.8 (35.9) *
Contribution of snacking to total discretionary energy (%) [d]	27.0 (31.4)	46.2 (34.7) *
Energy from discretionary food during snacking (%) [d]	41.3 (37.1)	52.6 (35.2) *
Total energy from snacking (%) [e]		

Dairy milk (cow, sheep, goat)	7.6 ± 0.2	8.1 ± 0.2
Sweet biscuits	6.5 ± 0.2	6.6 ± 0.2
Coffee and coffee substitutes	5.8 ± 0.2	5.5 ± 0.2
Cakes, muffins, scones, cake-type desserts	5.7 ± 0.2	5.9 ± 0.2
Pome fruit	5.7 ± 0.2	4.7 ± 0.2
Regular breads and bread rolls (plain/unfilled/untopped)	5.0 ± 0.2	-[g]
Sugar, honey, and syrups	3.6 ± 0.1	4.0 ± 0.1
Nuts and nut products	3.3 ± 0.2	4.3 ± 0.2
Tropical and subtropical fruit	3.2 ± 0.2	-[g]
Chocolate and chocolate-based confectionary	2.8 ± 0.2	4.8 ± 0.2
Beers	-[g]	4.5 ± 0.2
Wines	-[g]	3.0 ± 0.1
Consumers snacking (%) [f]		
Dairy milk (cow, sheep, goat)	30.4 [29.4 - 31.4]	43.3 [42.3 - 44.4]
Sweet biscuits	12.8 [12.0 - 13.5]	19.3 [18.5 - 20.2]
Coffee and coffee substitutes	28.9 [27.9 - 29.8]	43.5 [42.4 - 44.6]
Cakes, muffins, scones, cake-type desserts	8.3 [7.7 - 8.9]	11.1 [10.4 - 11.8]
Pome fruit	11.3 [10.6 - 12.0]	15.9 [15.1 - 16.6]
Regular breads and bread rolls (plain/unfilled/untopped)	13.1 [12.4 - 13.8]	-[g]
Sugar, honey, and syrups	20.6 [19.7 - 21.4]	29.1 [28.1 - 30.1]
Nuts and nut products	6.7 [6.1 - 7.2]	11.5 [10.9 - 12.2]
Tropical and subtropical fruit	7.8 [7.2 - 8.4]	-[g]

Chocolate and chocolate-based confectionary	6.0 [5.5 - 6.5]	13.9 [13.1 - 14.6]
Beers	-[g]	9.3 [8.7 - 10.0]
Wines	-[g]	6.5 [5.9 - 7.0]
Snacking intake (g) [(h)]		
Dairy milk (cow, sheep, goat)	62 [31 - 146]	62 [31 - 146]
Sweet biscuits	25 [17 - 37]	25 [17 - 38]
Coffee and coffee substitutes	250 [200 - 330]	281 [200 - 450]
Cakes, muffins, scones, cake-type desserts	98 [57 - 163]	105 [62 - 163]
Pome fruit	164 [164 - 188]	164 [158 - 188]
Regular breads and bread rolls (plain/unfilled/untopped)	64 [54 - 80]	-[g]
Sugar, honey, and syrups	7 [4 - 13]	8 [4 - 13]
Nuts and nut products	28 [14 - 36]	28 [15 - 36]
Tropical and subtropical fruit	98 [98 - 111]	-[g]
Chocolate and chocolate-based confectionary	33 [15 - 53]	30 [15 - 51]
Beers	-[g]	758 [379 - 1515]
Wines	-[g]	312 [208 – 594]

* p<0.001; ** p=0.497.

a. The objective definition of snacking uses time of day to define main meals and snacking periods. Snacking periods occurred between 9.30am – 11.30am (morning snack), 2.30pm – 5.30pm (afternoon snack), and 9.30pm – 5.30am (late night snack).
b. The subjective definition of snacking used the self-reported eating occasion provided by respondents during dietary recall. Snacking was defined as any of the following self-reported eating occasions: morning tea, snack, afternoon tea, beverage/drink, supper, other, extended consumption.
c. Data are expressed as % [95% confidence interval].
d. Data are expressed as mean (standard deviation).
e. Data are expressed as mean ± standard error.
f. Data are expressed as % [95% confidence interval].

g. Was not in the top 10 sub-major food and beverage groups by percent energy contribution to snacking.
h. Data are expressed as median [interquartile range].